MECHANICS' MAGAZINE,

AND

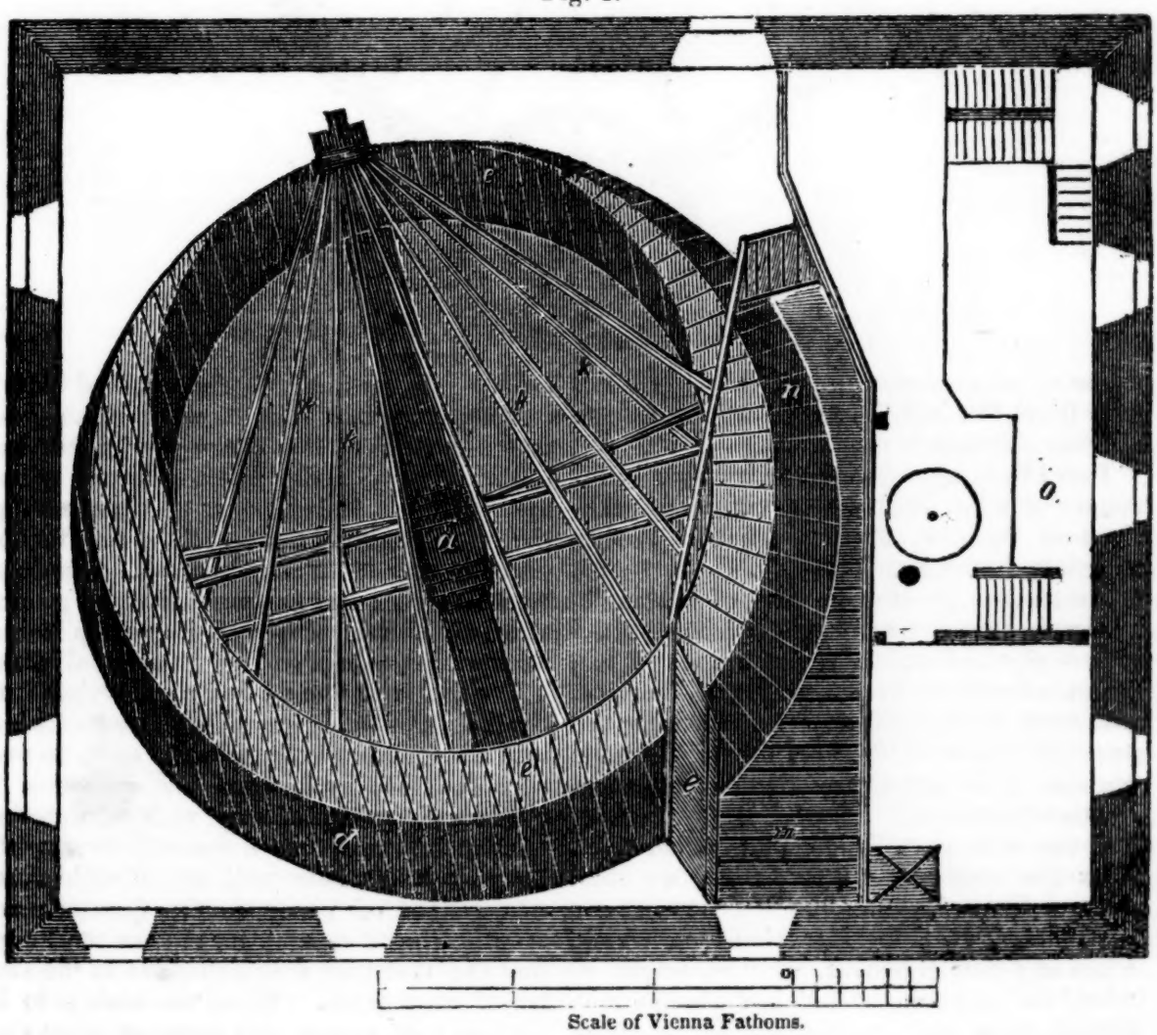
REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] JULY, 1834. [NUMBER 1.

"The man whose mind is irradiated with the light of substantial science, perceives the atmosphere as the agent under the Almighty which produces the germination and growth of plants, and all the beauties of the vegetable creation—which preserves water in a liquid state, supports fire and flame, and produces animal heat—which sustains the clouds, and gives buoyancy to the feathered tribes—which is the cause of winds—the vehicle of smells—the medium of sounds—the source of all the pleasures we derive from the harmonies of music—the cause of that universal light and splendor which is diffused around us, and of the advantages we derive from the morning and evening twilight. In short, he contemplates it as the prime mover in a variety of machines—as impelling ships across the ocean, blowing our furnaces, grinding our corn, raising water from the deepest pits, extinguishing fires, setting power looms in motion, propelling steamboats along rivers and canals, raising balloons to the region of the clouds, and performing a thousand other beneficent agencies, without which our globe would cease to be a habitable world."—DR. DICK.

AUSTRIAN OX-MILL.

Fig. 1.

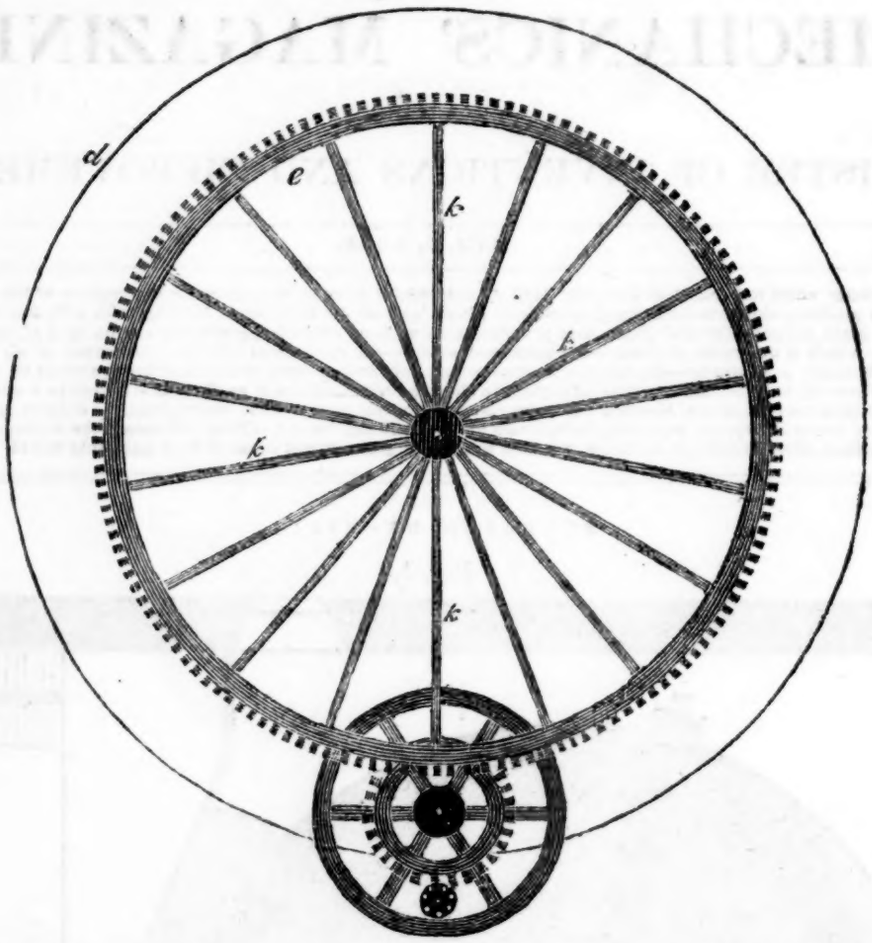


Scale of Vienna Fathoms.

The Art of Brewing—Ox Mill used in the Breweries of Vienna. [From the London Mechanics' Magazine.]

Of the treatises published under the superintendence of the Useful Knowledge Society, one of the very best was that on the "Art of Brewing," by Mr. David Booth; but owing (we believe) to some misunderstanding between the author and the Society, it was left in an incomplete state—two parts only, instead of four, having received the Society's *imprimatur*. Mr. Booth has,

Fig. 2.



under these circumstances, been induced to give Parts III. and IV. to the world through another medium.*

Part IV. is appropriated to brewing in foreign countries, and treats of the art as practised at Munich, Prague, Vienna, Berlin, Brussels, Louvaine, &c. Mr. Booth states, "that for the greater portion of the information in this chapter he is indebted to the manuscript and oral communications of two German brewers (from Vienna and Munich), who have been, and now are, visiting the principal towns of Europe, for the laudable purpose of acquiring information concerning their business."

From this part, being that which contains the most novel information, we shall make a few extracts.

And first, as to the *Bavarian beer*, which, when in prime condition, is "as bright as wine, and contains so much carbonic acid, that it is, in that respect, similar to champagne."

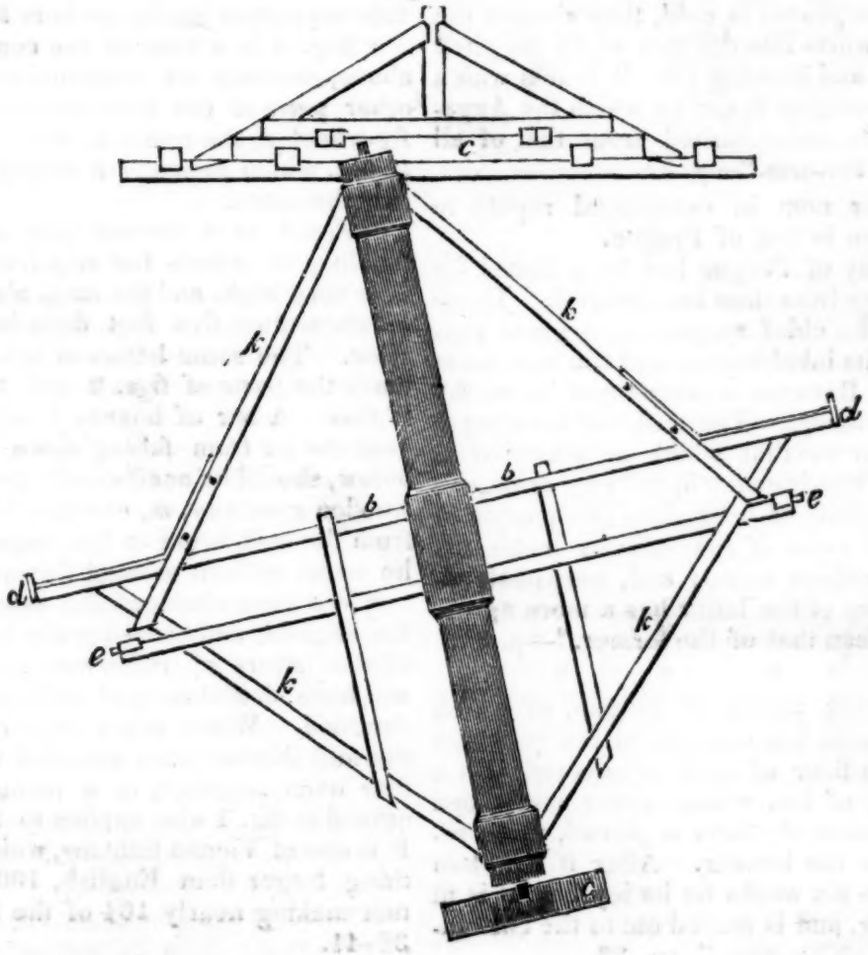
"The beer throughout all Bavaria is nearly of the same strength: usually between 3¼ and 3½ barrels to a quarter of malt. It is made wholly from malted barley and hops; and all sold at an uniform rate, which is fixed by law every year, according to the price of barley; so that there is but one kind of malt liquor for all classes, from the prince to the peasant. The rate for the present year is 16s. per barrel. The beer pays no duty; but the malt must be ground at a public mill, where an impost is levied, amounting to about half of its original value. The malt is screened before carrying it to the mill; and being generally cut with stones, it is also previously damped, in order to prevent the loss by dust. This operation is performed by sprinkling with a watering pan, at the same time frequently turning the heap till it has been well mixed with about two gallons of water to the quarter; and then leaving it to soak for nine or ten hours, that the moisture may penetrate to the centre of each grain. When the malt is to be bruised with rollers, this damping is not considered necessary."—p. 25.

* * * *

"The cellars in Munich are very deep under ground, so that the temperature never rises higher than between 7 and 8° of Reaumur, which is from 48 to 50° of Fahrenheit. In some of them ice is preserved through

* The Art of Brewing. Parts III. and IV. By David Booth. To which is added an Appendix concerning Burton Ale. London: F. J. Mason. 8vo., 1834, pp. 56.

Fig. 3.



the summer. It is within such cellars that the beer is cleansed, into casks that lie on their side, bung uppermost.

* * * *

"After the beer has thus lain from eight to ten months, it is reckoned to be fit for use; and for that end it is drawn off into small casks as wanted, which are immediately carried out to the publican, and on the same day drank by his customers: so that every publican must be supplied with beer every day from the brewery."—pp. 27, 28.

* * * *

"Great care is requisite in having the store-casks very clean and *sweet* before filling them, lest they should communicate a disagreeable flavor to the beer. In two towns this is effected, after they are well washed, by smoking them with burning sulphur; but in the rest of Bavaria it is done by lining them with pitch. The following is the manner by which this is effected at Munich: The store-casks, in which the beer is cleansed, are previously *pitched* every time for summer beer, and once a year for winter beer. Pitching is practised in this way: one end of the cask is taken out, and two English pounds of pitch for every barrel of its contents, if the pitching has only to be renewed (but double that quantity, if for the first time,) is set fire to on the bottom of the cask, and made to burn until the whole has become perfectly fluid. This being done, the fire is extinguished, by putting in the head of the cask and driving the hoops close; and then the cask is rolled about, and turned in every direction, so that the pitch may be spread over every part of the inner surface, which it will thereby cover with a crust of one eighth of an inch thick. This crust is apt to crack and blister, which causes the necessity of re-pitching every season. The professed object of this manipulation is cleanliness; but it doubtless communicates a peculiar flavor to the beer, which, however, is liked, and consequently required, by the customers of those brewers."—p. 29.

* * * *

"The brewers of this city (Augsburg) wash their coolers with great care, scrubbing them every week with Dutch rushes—the stalks of the *equisetum hyemale*; but, notwithstanding this apparent regard to cleanliness, they have one practice which we, in this country, should not venture to imitate. Like the rest of their countrymen, they

pitch their store-vats; but instead of waiting until the plaster is cold, they cleanse the fermented worts into the vats while the pitch is smoking and burning hot. It is this which gives the peculiar flavor by which the Augsburg beer is distinguished from that of all the rest of Bavaria."—p. 31.

The beer next in continental repute to the Bavarian is that of Prague.

"The city of Prague has been famed for its breweries from time immemorial. These constitute the chief support of a great proportion of its inhabitants; and the beer, next to that of Bavaria, is accounted to be the best in Germany. The mode of brewing is very similar to that which is practised at Munich. The brewers in the city draw one hundred gallons of beer from the quarter of malt, while those of the suburbs make ten to twelve gallons more; and, notwithstanding, the beer of the latter has a more agreeable taste than that of the former."—p. 31.

* * * *

"The beer vaults of Prague, of which every publican has one, are of the very best kind. The floor of each is covered with a deep mass of ice, which never melts, and upon this mass the beer is placed, when received fron the brewer. After it has lain from four to six weeks on its icy bed, it is fit for drinking, and is served out to the customers in that chilly state."—p. 33.

In treating of the method of brewing at Vienna, Mr. Booth gives the following description of a species of tread-mill, by means of which oxen are employed to drive the mill stones and rollers (for bruising the malt), which, though "little, if at all, known in this country," he thinks deserving of more extensive publicity, "believing that it would prove a cheap and convenient power in certain situations." We copy also, by permission of Mr. Booth, the engravings to which the description refers:

"Fig. 2 is a section, showing the position of the tread-wheel, *d d*, with respect to its angle of elevation as compared with the horizontal portion of the roof *p p*. The shaft *a*, at right angles, and fixed to the tread wheel, turns on pivots at the top and bottom, which are inserted into strong timber-work. The cog-wheel *c c*, parallel to the tread-wheel *d d*, and also fixed through its centre to the shaft *a*, communicates its motion to such other parts of the machinery as may be required. The wooden spurs *k k k k* sustain the tread-wheel, above and below, uniting a little above the cog-wheel, and fastened at their ends into the shaft. The rim *d d*, being that portion of the circumference of the wheel on which the ox treads, is further supported by the timbers *b b*.

"Fig. 3 is a view of the cog-wheel from above, showing its communication with the other parts of the machinery, such as the fly-wheel *f*, the crank *h*, &c. The spurs *k k*, &c. which preserve it steady in its place, are also seen.

"Fig. 1 is a ground plan of the whole building in which the tread-wheel stands. It is very high, and the main shaft is sunk in an excavation five feet deep in the ground-floor. The same letters of reference which mark the parts of figs. 2 and 3 also apply to this. A bar of boards, *l*, is fixed to prevent the ox from falling down into the pit below, should he accidentally get loose. The wooden gangway, *m*, enables him to get up from the stall below to the stage *n*, on which he walks without moving forward.

"We have abridged the description from the original, and consequently have left some of the letters of reference unnoticed; but we have doubtless said sufficient to be understood. When much power is wanted, the mill is sometimes supplied with three or four oxen together, in a team. The scale affixed to fig. 1 also applies to figs. 2 and 3. It is one of Vienna fathoms, which are something larger than English, 100 of the former making nearly 104 of the latter."—pp. 38–41.

It will doubtless be in the recollection of our readers, that the Burton ale brewers, moved by what was said of their peculiar modes of practice in the second part of this work of Mr. Booth's, applied to the Court of King's Bench for leave to file a criminal information against the publishers of the Useful Knowledge Society; and that, in consequence of Mr. (now Lord Chancellor) Brougham's afterwards stating to the Court, on the part of the Society, that they had, after due inquiry, satisfied themselves that there was no ground for imputing to the plaintiffs the use of any thing, save malt, hops, and water, in the manufacture of their beer, the rule to show cause was discharged. It appears, however, from the extract which follows, that Mr. Booth himself (incredible as it may seem) "was never consulted" with respect to these proceedings; and that had he been consulted, as he ought to have been, the records of the court might possibly have told a very different tale:

"On referring to Chapter X., Part II., of the Art of Brewing, which treats of Burton ale, it will be seen, that, in recommending the adoption of certain ingredients, the writer was careful not to impute the use of them to the licensed brewers; he well knew, that

for them every article except malt and hops was illegal, and subjected them to severe penalties. But the question arose, how much was insinuated, and how far such a suspicion might raise a prejudice against their beer—a circumstance directly opposite to the intentions of the author.

"One of the affidavits gratuitously acknowledged the occasional use of flour and salt, to assist the fermentation of the inferior ale; and the jalap, of which it only was said that 'some recommend' for the same purpose (and the use of which is doubted at page 28, Part I.), may as well be left out of the supposed-accusatory list of ingredients. These, then, are reduced to

Salt of steel -	2 oz. to 20 barrels.
Honey - -	1 lb. per barrel.
Sulphate of lime	6 oz. per barrel.
Black resin -	1 oz. per barrel.

"With respect to the proceedings in this prosecution, the writer of the alleged libel, though his character was in some degree at stake, *was never consulted.* It appears, from what followed, that several chemists were employed to analyse the ale, as well as the water of which it was made; and, had he known of their appointment, he would have told those scientific gentlemen, that the honey and resin (granting that they had ever been introduced) *would certainly escape their detection*—that the salt of steel, not being by weight one part in sixty thousand, would possibly be too minute for discovery; and that the sulphate of lime alone would probably be found. The result would have justified the prediction."—pp. 52, 53.

The Undulating Railway—Final Reply of Mr. Badnall to Mr. Cheverton. [From the London Mechanics' Magazine.]

Sir,—Mr. Cheverton's dreadful infliction—HIS ROD—hath, at last, fallen upon me, without his own character, or the good taste of your readers, being, in the slightest degree, "ill-consulted"—without the most distant apparent inclination to render your pages the medium of a personal quarrel between himself and me! HE will not descend to imitate my dull, vituperative style! HE would shudder to characterise an opponent as "a coarse practitioner from the *abattoir!*"—"a mere hacker of flesh and bones!" HE is a man of more gentlemanlike bearing than to fume out false accusations! No, Sir, HE stands upon too lofty an eminence! HIS philosophic and refined understanding could not possibly stoop to mere personal abuse, or controversial subterfuge! No, HE is the very prototype of wisdom!—an immortal emblem of refinement!—a breathing picture of urbanity and peace!—gentle as a lamb—sweet as honey—mild as new milk—"*parfaite amour*" in toto! HE is not the cur who, when he meets with an unflinching antagonist, flies growling and barking to his kennel! HE is not the tame-hearted pugilist who swears that a blow is false because he cannot parry it!—nor is HE slippery as the eel, which, by its twistings, and its twinings, and its slime, evades the grasp of its pursuer, and buries itself in its native mud! No, Sir, Mr. Cheverton is a being of far different stamp!—his mental qualifications—his scientific reputation—his temper—his writings—his sentiments—will *all* bear the test of the most rigid scrutiny! HIS theories will *all* be established by practical results! The halo round HIS head will brighten as each opinion becomes confirmed by experiment! In a word, HIS letters on "the undulating railway," while they will immortalize the fame of the Mechanics' Magazine, will become never-dying monuments of sterling talent and correct observation, from the hour when *that trial* takes place, which a Dalton* has been indiscreet enough to recommend! Till that hour arrives, I almost feel inclined to "leave him alone in his glory," in order that I might, with double effect, magnify his transcendent name, and prostrate myself before his living monument of wisdom! But—I cannot resist the inclination which his letter has excited, to pay him some passing homage; for neither the "war-whoop of the Mohawk," nor the "inspiring blast of the clarion," shall be compared to the sounding of his brass, or the tinkling of his cymbals!

Yet how shall I, to whom "nature has been so niggardly," sufficiently extol the praise of one who, declining to quarry all ignoble game, is able to defend himself against a weapon capable of dividing "soul from body," the very "marrow from the bones?"

Immortal champion! inspired philosopher! tender and kind-hearted victor! may this humble panegyric be a memento of my deference to thy fame, as long as the Mechanics' Magazine may survive the wreck of time—and may that be for ages!

Having thus, Mr. Editor, in sincere good humor, squared one part of my account with Mr. Cheverton, I beg to acknowledge, like him, the gratification which I feel at the prospect of this too lengthened controversy being terminated. The venom which he thought it prudent, *in the first instance*, to cast on me, I good-humoredly endeavored to throw back; but his last effusion was of so different a nature—so characteristic of a noble and unoffending disposition, that I have met, as it deserved, with an unbounded expression of veneration. As you have admitted, in your valuable columns, his unmeasured declamations, I trust that equal justice may be done to me; and that you will, by publishing this reply, permit me the opportunity of proving that he who cannot, by fair and manly argument, defeat a literary or scientific opponent, stands little chance of doing so by an opposite course of conduct.

Such was my object in noticing Mr. Cheverton's extraordinary letter (vol. xx. p. 73). Had it been otherwise, my silence should have

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* Alluding to the trial of the undulating railway, which Drs. Dalton and Lardner have recommended to be instituted on the London aad Birmingham line.

shown my contempt for the vulgar sneers and false accusations with which that document abounded. But it is passed, and I congratulate Mr. Cheverton on the victorious result of his attack.

As no unnecessary time will now be lost in trying, by ample experiment, on some line or other, the merits of the undulating question, I would propose, to your readers in general, that all further controversy should rest until the experiment be made. Practice can alone determine whether I or my opponents have been right or wrong in our anticipations, and whether Mr. Cheverton's arguments or mine will be creditably substantiated. The note which you have attached to my last communication leads me to hope that you may concur in my present opinion ;* and if so, while Mr. Cheverton may try at his leisure any further experiments he may please at the National Gallery of Practical Science, I will direct my attention to the means of elucidating the problem in a far more satisfactory way. If, on a trial being made, I find myself in error, I will frankly confess my incompetency to argue this subject, and my folly at having so warmly and so boldly espoused it—if otherwise, I trust there are many of your readers who will give me credit for some patience, and for some intellectual capabilities beyond the *canaille* sphere in which Mr. Cheverton has been so anxious to place me.

The test shall not be less difficult than I originally proposed. Whether the experimental railway be 6, 8, or 10 miles in length, I maintain that *any locomotive engine will traverse an undulating line, with a load which is its maximum load on a level, in half the time which it will occupy in traversing the same distance with the same load on a dead level railway, and without greater waste or consumption of fuel.* And I, moreover, say, *that any locomotive engine will traverse an undulating line at a great velocity with a load† which that same engine cannot move upon a level line.*

Whenever this trial may take place, your readers shall have ample notice of it ; and if you, Sir, will undertake the office of umpire, I shall cheerfully abide by your decision.

In the mean time, it would be mere repetition, and an unnecessary prolongation of our arguments, were I to reply at length to the more solid parts of Mr. Cheverton's last letter. One or two points, however, I cannot help touching upon. First, as to "*locomotive duty*," which he so frequently harps upon. *All* my arguments, of late, have been almost confined to the practical consideration of locomotive duty. *I do* say that by employing gravity as an *auxiliary* force, *we save* locomotive power. What! Mr. Cheverton exclaims, can you take advantage of gravity without being obliged to repay what you borrow ? *Yes*, is my reply—and yet *no perpetual motion*, Mr. Cheverton! How ? Mr. Cheverton would ask. My answer is simply this, and whether it be true or false, *experience will prove—velocity* is *gained* by taking advantage of gravity. *Friction* on railways is, in my humble opinion, *not as the spaces*, but as the *times or velocities*. If this be true—and if a *greater velocity* be attainable on an undulating than on a level railway, there is, (exclusive of any difference in friction arising from the particular inclination of the plane,) *less friction on an undulating than on a level railway*. Locomotive steam power is therefore *saved*.

The next point I wish to allude to is Mr. Cheverton's observations about a lecture given to me, or some of my acquaintances, by Professor ******, in the National Gallery. Does he mean Professor Ritchie ?—if so, I was not present. That gentleman and Mr. Locke had, I know, a conversation together; but the only time that I have had an opportunity of conversing with Professor Ritchie on the subject, was recently, when he did me the honor to spend part of the day with me in Liverpool. In a word, the only individuals whom I can call to mind as having expressed a decided opinion in my presence, when in London, adverse to the undulating railway, were Mr. Saxton and a friend of his, whom I begin to think was Mr. Cheverton ; and as to any acquaintance of mine then present being afraid of their "*badgering*," I *rather think* Mr. Cheverton has imbibed an erroneous impression. If it were necessary, I could publish, in this letter, a list of persons who are advocates of the undulating railway, amply sufficient to out-balance the strongest testimony which Mr. Cheverton and his friends can advance against it,—but the best testimony is *practice*, and *upon that I throw the merits of the case.*

Lastly, Mr. Cheverton offers some important practical objections, which I confess to be more worthy of notice than *any points* which he has hitherto advanced. But, serious as they appear, they will not, on consideration, be found of any real weight. In the first place, we have to determine what is a *safe velocity*—that being determined, how can it be attained on a level railway with heavy loads ? Unless gravity be employed at starting, as an auxiliary force, a much more powerful engine would be requisite to *move* a heavy load from a state of rest, than to continue it at a given maximum velocity ; and *if gravity be employed at starting*, the engine and load *must ascend again to a like summit*, in order to maintain the starting advantage ; and *if so*, what is this but an undulating railway ? Does Mr. Cheverton imagine that a perfect cycloid, or a perfect arc, alone constitute my idea of an undulation ? Far from it—he may descend a hill, run four miles on a level, and ascend to an equal elevation ; and by doing this would realize a system of undulation which might, probably, be adopted with advan-

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* We do perfectly ; but it must be with reservation to the claims of Mr. Whitehead and Mr. M'Kinnon, to whose papers, in opposition to the undulating system, (now many months in hand,) we stand pledged to give insertion. We shall be glad to have their assent to the proposed postponement in the text.—Ed. M. M.

† It will occur to your readers that I have frequently stated as my opinion, that an engine would convey, on an undulating line, *at least* twice the load which the same engine could move on a level, at the same velocity. Such is my opinion now; but the test which is above proposed will, I am sure, be deemed sufficient to decide the question at issue, and it will be found to accord with the terms of my original challenge.

tage in some cases; for, with heavy loads, a velocity might be generated by the first descent which could not, with the same engine, be generated on a dead level; and this being maintained on the level, would enable the load to ascend to a like elevation. But supposing the undulations to be a series of regular segments of circles, wherein consists the difficulty of sustaining an average velocity of 20 or 30 miles per hour, without an increase of speed? Is it necessary to work the engine down every descent? One of the leading advantages which I anticipate is the great saving of that steam expenditure which is now necessarily incurred in maintaining high velocities on a level. Again, it will require very powerful engines to attain high velocities, with heavy loads, on level railways: whereas, such powerful engines will *not* be so necessary on undulating railways, and for the reasons previously stated.

I now, Sir, unless again attacked by Mr. Cheverton, close with pleasure this twelvemonth's warfare, anxiously awaiting the result of practical trials; and sincerely hoping, although a few waspish observations have occasionally intermingled with a subject to which they should have been altogether foreign, that some information and benefit may have been derived from the discussion.

I am, Sir, with great respect, your very obedient servant, R. Badnall.

Douglas, March 27, 1834.

P. S.—S. Y. and I have, in one respect, misunderstood each other. He is certainly right in believing that the pressure upon an inclined plane, (alluding to the force necessary to draw a body up,) is as the base to the length: therefore, at an angle of 45°, my statement appeared erroneous; but, taking into consideration the resolution of the forces—that at an angle of 45° the length of the base is equal to the perpendicular elevation—and that taking the length of the plane as the entire force of gravity, it forms the diagonal to two equal sides of a square; the oblique forces are therefore equal—that is, at an angle of 45°, the force of gravity which urges a body down a plane, or retards its ascent, is exactly equal to the force of pressure on the plane. For instance, if L be the length, B the base, and E the elevation, at an angle of 45° E is equal to B; and although the pressure on the plane is $\frac{B}{L} \times L$, yet the tendency to descend is $\frac{E}{L} \times L$; the one force, therefore, is equal to the other. I close my discussion with S. Y. with every feeling of respect.

The Editor of the London Mechanics' Magazine afterwards states, that

"'An Attentive Reader of the Undulating Controversy' proposes that a sum of money should be staked on the result of a trial of an undulating line. He requests us to ask, 'Whether Mr. Badnall and Mr. Cheverton have confidence enough in their respective opinions to come forward singly, or supported by their friends and advocates, and stake a sum of money on the event?' He, for one, he adds, 'would be happy to back Mr. Badnall.' The wager, our correspondent suggests, might be laid so that 'the winner should pay for the expense of the trial; which expense, in case of failure, would be merely that of laying down the rails and taking them up again, on any projected line.' The sum he names is from £1,000 to £2,000."

This challenge has brought Mr. Badnall out again, and we presume for the last time. The controversy has been conducted with good feeling on both sides. The result we shall soon know, and our readers shall very speedily be made acquainted with it.

Wager of £1,000.—Sir: In your "Notes and Notices" of last week, I observe a correspondent suggests that a wager might be laid between Mr. Cheverton and myself, or our friends, on the result of a trial on an undulating line. Individually, I am not in the habit of offering or accepting bets, but if Mr. Cheverton feel inclined to adopt the recommendation of your correspondent, I shall be happy, on the part of my advocates, to enter, (through the medium of your Magazine,) into an agreement with him, and if he be similarly inclined, to stake £1,000 on the result of a trial on five or ten miles of road. The stakes to be lodged in a banker's hands. I trust that the memorial which has been presented to the London and Birmingham Railway Directors may induce them and their engineer, Mr. Stephenson, to institute, as I anxiously anticipate, an impartial trial on that line of road, *on their own account;* in which case, if Mr. Cheverton be the winner, he will gain £1,000 without deductions. Should he prefer betting a greater sum, I shall be happy to submit his offer to those of my friends who may feel inclined to speculate.

The only sum that I, in conjunction with my partner, Mr. Stephenson, should feel disposed to win or lose, (which may be added to the stakes,) would be the expense of a dinner and wine, at the Albion Hotel, Aldersgate street, for all who have written on the subject, *pro* or *con*, in the Mechanics' Magazine—your worthy self, Sir, being President.

Yours, very obediently,

Richard Badnall.

Manchester, April 7, 1834.

On the subject of the proposed communication by steamboats between Calcutta and England, the Calcutta Courier of the 23d January has the following paragraph:

Steam Communication with England.—Capt. Ross has proceeded to Socotra in the pilot brig Henry Meriton, taking with him Capt. Jump, who, we believe, will return in charge of the vessel. Capt. Jump is spoken of as likely to be the future commander of the Forbes on her trips to the Red Sea, for which he has tendered his services. In the mean time, arrangements are making to forward coal to the several de-

pots. The Fette Salem is now receiving 500 tons of English coal for Judda, at the freight of 27 rupees per ton,—a very low rate compared with the terms on which the Red Sea depots were provided for the Hugh Lindsay. A suggestion of Capt. Ross is now under the consideration of the committee, to anticipate the departure of the Forbes on the first trip, by altering the date to the 20th April instead of the 1st May, as lately announced. The motive for the alteration is, that starting on the 20th of April, it is believed that the steamer will be able to get down the bay and clear of Ceylon before the earliest period at which storms are to be apprehended.

We understand that the Merchants' Steam Committee have given in a plan to government, offering to undertake to keep up a quarterly communication with England by the Suez route, both from Calcutta and Bombay, with four large steamers of 800 tons burthen, each of them furnished with a pair of 100-horse engines—one of the steamers to run from Bombay, two from Calcutta, and one between Alexandria and the British Channel,—provided government will give them five lakhs annually in compensation for carrying the mail and all public dispatches.

RAILROAD ACROSS THE ISTHMUS OF DARIEN.—We perceive, by the following extract from a Panama paper, that this great enterprize is likely to be undertaken under highly favorable auspices. The results to commerce, from the establishment of a land carriage of this description, between the two great oceans, cannot fail to be of a highly important character.

"To the Deputies of the Provincial Assembly of Panama:

"Gentlemen,—The opening of a carriage road or railway from the Atlantic to the Pacific, has for a long time engrossed the minds of many persons, not only in this capital, but in far distant countries; for knowing the important situation of this province, it is impossible not to conceive the advantages that would accrue, should this new path be opened to general commerce. Such a flattering idea had given rise to various projects to carry this grand work into execution, which have not been realized, perhaps from the lack of a perfect knowledge of the localities, or from a want of sufficient funds, or may be from the political vicissitudes that the country has been subjected to of late. But now that we have fortunately acquired the re-establishment of the empire of the law, and tranquillity has been pretty well secured, I believe that an impulse ought to be given to this interesting undertaking, upon which depends almost the absolute vitality of this declining province.

"With such an object in view, I take the liberty of soliciting that there be granted to me an exclusive privilege, on the same terms that the old chamber of the district granted to Mr. Malcolm M'Gregor, that I might endeavor to get this project put into execution, not doubting that the honorable chamber will receive and protect my request; and being penetrated with its justice and public convenience, will decree favorably. "JUSTO PAREDES.

"Panama, October 2, 1833."

Some days ago, we published an extract from the "Constitucional de Cundinamarca," concerning a project to open a more secure and speedy commercial communication across the Isthmus of Panama. Since then a Panama paper has fallen into our hands, from which we have derived more authentic information regarding this most interesting enterprize. From it we have translated the memorial of Mr. Paredes, which is prefixed to this article. In the same paper, the provincial decree, granting the privilege to that gentleman, also appears, along with a copy of the former one granted to Mr. M'Gregor. The new decree contains some slight modifications of the articles of the old; one of them is, that the road shall reach to the city of Panama, and another, that Mr. Paredes is not bound by the old decree, which only allows two years to carry the project into execution from the day of its passing, otherwise it becomes null and void, but that the new patentee is not bound, nor does he enter into the enjoyment of the privilege until the day that the Governor of the province shall communicate to him that the decree has been approved of by the National Congress.

We feel a considerable degree of pleasure in giving publicity to the Memorial which Mr. Paredes presented to the Provincial Chamber, and which is submitted for approval to the National Congress of New Granada, now sitting, and we cannot for a moment doubt that body will receive kindly a project upon which depends the future happiness, not only of the Isthmus, but also of this Island; for when once such an expeditious communication between the Atlantic and the Pacific shall be opened, will the navigation round Cape Horn be risked, which causes so many dangers and loss of time? Certainly not: for the general deposit will be in this island, from whence will be dispatched the cargoes for the ports in the Pacific, which are now supplied by vessels round the Cape.

It has been also very satisfactory to us to learn that some of the respectable merchants of this city have offered their support to Mr. Paredes, to carry this great work into operation, assuring him that in London a great many more will purchase shares in the company, which, added to those in Jamaica and Panama, will form a sufficient number for the execution of the project, without even counting upon the capitalists of France and the U. States.

We understand that the concessions in favor of the Memorialists could not have been more munificent, whether we consider the extending the privilege to the long period of forty years, or whether we consider the permitting of the exclusive transport of all kinds of merchandize, produce or metals, in carriages belonging to the company. These are truly powerful stimulants, to induce the European and Ameri-

can capitalists to take a considerable share in an enterprize which offers such incalculable advantages. The most authentic accounts that have reached us state that the distance from Porto Bello to Panama is only 14 leagues, and that the expense of putting the plan into active operation will cost nearly half a million of dollars.

The good reputation of Mr. Paredes, his commercial relations with this city, the facility with which he expresses himself in different languages, added to his honorable character and personal activity, incline us to augur well of the undertaking, whilst the grandeur of the enterprize makes us quite sensible of his patriotism, his judgment, and the knowledge which he possesses of the important situation of his country. If every Colombian thought as he does, that country would soon prosper, and instead of civil war and intestine quarrels, peace, good order and tranquillity, and industry, would be established upon the firmest basis.—[Kingston, Jam. Chronicle.]

Draining.—The following, from the Farmers' Register, affords an instance of great perseverance. The writer disapproves of covered drains. They are, however, far the best, except where a large body of water is to be carried off.

"My main drain," says he, "is something less than 3000 yards in length, having the capacity to receive and discharge the spring and flood water from seven or eight thousand acres of land. 1800 yards were cut through a mill pond, which was made by a dam not more than two and a half feet high, which is now put down, by the kindness of the owner. Much of the country around is precipitous and broken; the water from which brought great quantities of sand and mud into my drain, and often made it necessary to clean it out fall and spring. This alone was great labor. Thirty-three years have passed over me since I began the work, and I cannot say that it is perfect. A drain like this must have no angles in it; for they create eddies, in which all washings will be left, and the work ultimately ruined. This important fact in draining I had to learn by experiment; and upon so long and crooked a stream, (and that a boundary,) to straighten all the angles, and make the drain at my own cost and loss, was not exactly pleasant. As a short rule for making drains, let me say that they should be *straight*, and of *full* capacity to contain the water thrown into them, always taking care to begin at the outlet or lowest point. By measure and estimate, sufficiently accurate for all my purposes, I have not less than thirty thousand yards of water and fence ditching, fifteen-sixteenths of which is necessary to the drying and draining of my farm. Not less than one-quarter of all these must be scoured and cleansed every year. Like a gambler, I was drawn into this work by imperceptible degrees, and finally played on because I had already lost so much. Separately considered as a matter of profit, I am not prepared to justify such expensive works. Nevertheless, they show young farmers that perseverance, with a very limited degree of knowledge and experience, will, in time, surmount what would seem to be insuperable difficulties. Though my land was once remarkable for its great growth of rushes, I believe it would now be difficult to find one. Clover and plaister operate well even upon that land that was covered 50 years by the mill pond. As for covered drains, I have made many, but they were very unsatisfactory; and I would not advise any to make them.

History of Astronomy—its various Systems, &c. [Continued from vol. iii., p. 298.]

ON LIGHT.

Fairest of beings! first created light!
Prime cause of beauty! for from thee alone
The sparkling gem, the vegetable race,
The nobler worlds that live and breathe their charms,
The lovely hues peculiar to each tribe,
From thy unfading source of splendor draw.
In thy pure shine with transport I survey
This firmament, and these her rolling worlds,
Their magnitudes and motions.—[Mallet.]

The nature of light has been the subject of speculation and conjecture among philosophers, from the first dawnings of philosophy to the present day. But of all the conjectures which have been advanced on this curious and interesting subject, there is scarcely one supported by evidence sufficient to entitle it to preference over the other. There are, however, two opinions on this subject which have prevailed more generally than any of the others, and therefore it may be proper to notice them here, although the design of the present work is rather to state what is *known* respecting any phenomenon than to indulge in conjectures concerning it.

The celebrated Huygens considered light as a subtle fluid filling space, and rendering bodies visible by the undulations into which it was thrown. According to this theory, when the sun rises it agitates this fluid, the undulations gradually extend themselves, and at last, striking against our eyes, we see the sun. This opinion of Huygens was adopted by Euler, one of the best mathematicians that ever lived, who exerted the whole of his consummate mathematical skill in its defence. Sir I. Newton, and many other distinguished philosophers, consider light as a substance consisting of small particles constantly separating from luminous bodies, moving in straight lines, and rendering other bodies luminous by passing from them and entering the eye. Newton has been at great pains to establish this theory, and has certainly shown that all the phenomena of light may be mathematically deduced from it.

While Huygens and Euler have attempted

to support their hypothesis, rather by starting objections to Newton's than by bringing forward direct proofs, Newton and his disciples, on the contrary, have shown that the known phenomena of light are *inconsistent* with the undulations of a fluid, and that on such a supposition there can be no such thing as darkness at all. They have also brought forward a great number of direct arguments in support of their theory, which it has been impossible to answer.* But without giving a decided preference to any theory, we shall proceed to state some of its properties.

Roemer, a Danish astronomer, while engaged in making observations on the satellites of Jupiter, found that in eclipses they emerge from the shadow at certain times a few minutes later, and at others a few minutes sooner, than they ought to have done, according to the tables which had been previously constructed to show the times of their revolutions, eclipses, &c. On comparing these apparent irregularities together, he found that the eclipses happened before or after the computed time according as the earth was nearer to or farther from Jupiter. Hence he formed the ingenious conjecture, which was soon demonstrated to be the case, that the motion of light is not instantaneous, as was then generally believed, but that it required a certain portion of time to pass from the luminous body to the eye of the observer. According to Roemer's calculation, it was about *seven minutes* in traversing the radius of the earth's orbit; but it has since been found, that when the earth is exactly between Jupiter and the sun, his satellites are eclipsed about 8¼ minutes sooner than the time found by the tables; but when the earth is nearly in the opposite point, these eclipses happen about 8¼ minutes later than that determined by the tables. It is therefore concluded, that light takes about 16½ minutes of time to pass over a space equal to the diameter of the earth's orbit, which is at least one hundred and ninety millions of miles; it therefore moves at the rate of nearly 200,000 miles per second, which is about 10,300 times faster than the earth in its orbit, and 1,550,000 times quicker than a cannon ball.†

The velocity of light being known, it is easy to know the time it requires to arrive at the earth from any of the planets, or even the fixed stars, if their distance be known. For it has been ascertained, that the reflected light of the planets and satellites travels with the same velocity as the direct light of the sun or fixed stars; and that the velocity is the same from whatever distance it comes.

The discovery of Roemer has been completely confirmed by another most important discovery made by our countryman, Dr. Bradley, while engaged in making a series of observations with a view to determine the annual parallax of the fixed stars. This celebrated astronomer found that the aberration or difference between the true and apparent place of a fixed star is occasioned by the progressive motion of light, combined with the motion of the earth in its orbit; and that this *aberration*, when greatest, amounts to 20″·232. Now, the earth describes an arc of 20″·232 in 8′ 13″, the time that light takes to pass over the semidiameter of the earth's orbit. This circumstance, therefore, not only affords one of the most convincing proofs of the motion of the earth in its orbit, but entirely overthrows both the Ptolemaic and Tychonic systems, and completely establishes the motion of the earth.

As the rays of light are known to proceed only in straight lines from luminous bodies, and as the earth is constantly moving forward in its orbit, it is evident that a ray of light proceeding from any celestial body, will impinge on the earth at a different point from what it would have done had the earth been stationary. It is therefore necessary, in making astronomical observations with nicety, to make allowance for the aberration. When a fixed star or planet, for example, is seen through a tube or telescope, the tube does not point exactly to the *true* place of the star or planet, but to its *apparent* place, which is always more advanced in the direction we are moving than its true place, by a quantity equal to the aberration of the object.* But this will, perhaps, be better understood by the following illustration, which is given by Mr. Maupertuis, in his Elements of Geography.

"The direction," says he, "in which a gun must be pointed to strike a bird in its flight, is not exactly that of the bird, but of a point a little before it, in the path of its flight; and that so much the more as the flight of the bird is more rapid, with respect to the

* M. Delavel maintains that all light is reflected by white particles, and colored in its transmission. No transparent medium reflects any light when examined within a blackened bottle; this is shown by experiments on sixty-eight kinds of fluids, and on many kinds of glasses, and other substances. For this, and for the colors of the sea, M. Delavel proposes a very singular theory; but those who wish to become particularly acquainted with it, must consult his work on the permanent colors of opaque bodies.

† The real time which light takes to pass from the sun to the earth is 8 minutes 13 seconds.

* The aberration not only affects the longitude of a star or planet, but also its altitude, declination, and right ascension.

flight of the shot. In this way of considering the matter, the flight of the bird represents the motion of the earth, and the flight of the shot the motion of the light proceeding from the object."

Many philosophers have attempted, not only to compare the light of the stars with that of the sun, but also to ascertain their distances by comparisons of this kind.

The Rev. Mr. Mitchell, in an elaborate and ingenious paper in the Transactions of the Royal Society, states, that our sun would still appear as luminous as the star Sirius, although removed to 400,000 times his present distance; and that the fixed stars cannot be nearer than this, if they be equal to the sun in lustre and magnitude, and that they are so is the opinion of the most celebrated astronomers of the present day. Euler, who has already been mentioned, makes the light of the sun equal to 6,500 candles at one foot distance; the moon equal to one candle at 7½ feet distance; Venus to one at 421 feet; and Jupiter to one at 1320 feet. From this comparison it follows, the light of the sun exceeds that of the moon 364,000 times. It is therefore no wonder that the attempts which have been made by some philosophers, to condense the light of the moon by lenses, have been attended with so little success. For, should one of the largest of these lenses even increase the light of the moon one thousand times, still, in this increased state, it will be three hundred and sixty-four times less than the intensity of the common light of the sun.

The intensity of light has been found to vary as the square of the distance; for if an object be placed one foot distant from a candle, it will receive four times more light than when it is removed to double the distance, nine times more than when it is removed to three times the distance, and so on.

Of the Atmosphere and Astronomical Refraction.—The earth is surrounded by a thin fluid mass of matter, called the air, or atmosphere, which revolves with it in its diurnal motion, and goes round the sun with it every year. This fluid is both ponderous and elastic. Its weight is known from the Torricillian experiment, or that of the barometer; and its elasticity is proved by simply inverting a vessel full of air in water.

The atmosphere at the earth's surface being pressed by the weight of all above it, is there pressed the closest together; and therefore the atmosphere is densest of all at the earth's surface; and its density necessarily diminishes the higher up. For each stratum of air is compressed only by the weight of those above it; the upper strata are therefore less compressed, and consequently less dense, than those below them.

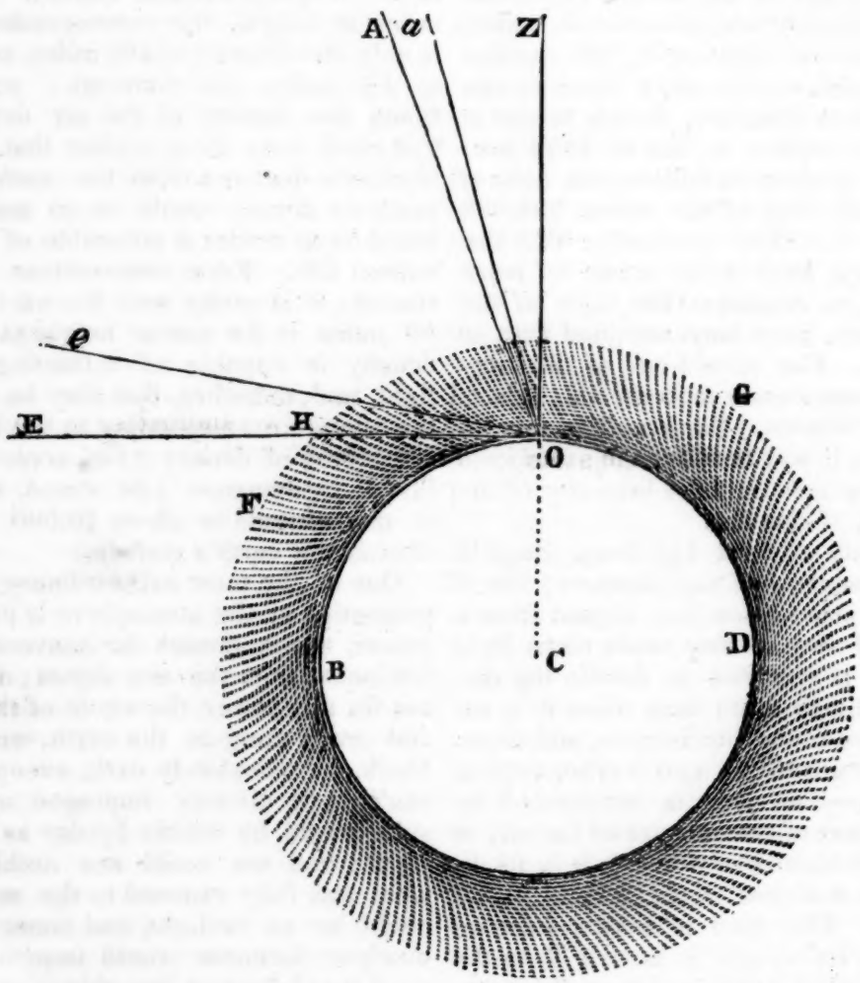
The pressure or weight of the atmosphere has been repeatedly determined, by various experiments, to be about fourteen pounds on every square inch of the earth's surface. Hence, the total pressure on the whole surface of the earth is 10,686,000,000 hundreds of millions of pounds avoirdupois.

From a number of experiments made on the density of the atmosphere, at various altitudes, by means of the barometer, it has been ascertained, that if heights from the earth's surface be taken in arithmetical progression, the density of the corresponding strata of air decreases in geometrical progression. Thus the density of the atmosphere is reduced one half for every 3½ miles of perpendicular ascent. At seven miles in height, the corresponding density is only one fourth; at 10½ miles, one eighth; at 14 miles, one sixteenth: and so on. Since the density of the air decreases at this rapid rate, it is evident that at a very moderate distance from the surface of the earth its density would be so much diminished as to render it incapable of sustaining animal life. From observations and experiments, it is pretty well known that 45 or 50 miles is the utmost height at which the density is capable of refracting a ray of light, and, therefore, this may be considered the altitude corresponding to the least *sensible* degree of density; for, according to the law of its decrease, just stated, the density at this altitude is above 10,000 times less than at the earth's surface.

One of the most extraordinary and useful properties of the atmosphere is its reflective power, which causes the heavens to appear luminous when the sun shines; for, were it not for this power, the whole of the heavens, and every thing on the earth, would appear black, or completely dark, except what the sun's rays directly impinged upon. The stars would be visible by day as well as by night; and we could see nothing except what was fully exposed to the sun. There could be no twilight, and consequently the blackest darkness would immediately succeed the brightest sun-shine when the sun set; and the transition would be equally sudden from the blackest darkness to the brightest sun-shine when the sun rose. But by means of the atmosphere, we enjoy the sun's light reflected from the aerial particles for some time before he rises, and also for some time after he sets. For when the earth, by its revolution on its axis, has turned any particular place away from the sun, the atmosphere above that place will continue

to be illuminated for some time. However, as the sun gets farther below the horizon, the less will the atmosphere be illuminated; and when he is *eighteen* degrees under the horizon, it ceases to be illuminated, and then all that part of the heavens which is over the place will become dark; for the place will then be turned too far from the sun, and his rays will strike too high on the atmosphere to be refracted or bent downwards at that place. In consequence of the refractive power of the atmosphere, all the heavenly bodies appear higher than they really are: for on account of the variation in the density of the air, a ray of light in passing through it will be refracted at every instant, and consequently the path of the ray will be a curve. And as an object is always seen in the direction in which the rays of light proceeding from it enter the eye, it is evident every celestial body will appear more elevated above the horizon than it actually is, by a quantity equal to the refraction which a ray of light suffers in passing from it through the atmosphere to the eye of the observer.

When the object is in the zenith, the refraction is quite insensible; but it increases as the altitude of the object diminishes, till it reaches the horizon, and then the refraction is greatest; for the rays which proceed from the object, in that situation, enter the atmosphere more obliquely than in any other, and consequently are more turned out of their course. This will be evident from an inspection of the following figure:



Where B O D represents the surface of the earth, O the place of an observer, and F G H the surrounding atmosphere. A ray of light proceeding from a body, Z, in the zenith is not refracted; but if it proceed from a body at A, it will enter the eye at O, and appear in the direction O *a*; if the body be in the horizon, as at E, the rays proceeding from it will enter the eye at O, and appear to come in the direction *e* O.

On some occasions, the horizontal refraction amounts to 36 or 37 minutes, and generally to about 33 minutes, which is equal to the diameter of the sun or moon; and therefore the whole disc of the sun or moon will appear above the horizon, both at rising and setting, although actually below. This is the reason that the full moon has sometimes been seen above the horizon before the sun was set. A remarkable instance of this kind

was observed at Paris, on the 19th of July, 1750, when the moon appeared visibly eclipsed, while the sun was distinctly to be seen above the horizon.

At some seasons of the year, the sun appears ten minutes sooner above the horizon in the morning, and continues as much longer above it in the evening, than he would do were there no refraction; and at a mean rate, about seven minutes on any day of the year. The refraction varies, however, very much with the state of the atmosphere. In cold dry weather the air is more dense than in warm weather; consequently the refraction is greater in cold weather than in warm, and for the same reason, it is greater in cold countries than in hot ones.

A remarkable instance of this is mentioned by Dr. Smith, in his Optics, where he states that some Hollanders, who wintered in Nova Zembla, in the year 1596, were surprised to find, that after three months' constant darkness, the sun began to appear seventeen days sooner than the time by computation deduced from the latitude, which was 76 degrees. Now, this phenomenon can only be accounted for by the extraordinary refraction of the sun's rays in passing through the cold dense air in that climate.

At the same altitudes, the sun, moon, and stars, all undergo the same refraction; for at equal altitudes the rays which proceed from any of these bodies suffer the same inclination.

The horizontal refraction being the greatest, causes the sun and moon, at rising and setting, to appear of an oval form; for the lower edge of each being seen through denser atmosphere than the upper edge, is more refracted, consequently, the perpendicular diameter must appear shortened, while the horizontal diameter, (which is not affected by refraction,) remains the same, and in this way the oval appearance is produced. For the same reason, two fixed stars that are near the horizon, and right above each other, appear nearer than when they are high above the horizon; and if they are both in the horizon, but at some distance from each other, then they will appear at a less distance than they really are; for the refraction makes each of them higher, and consequently must bring them into parts of their respective vertical circles, which are nearer to each other, because all vertical circles converge and meet in the zenith. Hence, in all astronomical calculations, allowance must be made for refraction, before the true altitude of any celestial body can be obtained. Tables containing this allowance for all altitudes are to be found in every work on practical astronomy.

The atmosphere not only occasions celestial bodies to appear higher than they really are, by bending the rays of light as they pass through it, but it also affects terrestrial bodies in the same way. The quantity of this refraction is however found to vary considerably with the different states of the atmosphere, and is therefore very uncertain. But, at a mean rate, it may be taken at one fourteenth part of the distance expressed in degrees in a great circle: or, according to Professor Playfair, it is about one seventh part of the correction for the earth's curvature, answering to the distance between the observer and the object.*

Steamboat Travelling.—The cabins of western steamboats present peculiar aspects. They possess all the splendor and comforts of an eastern boat, and afford other pleasures which we meet with no where else. A person embarking in a steamboat generally expects to remain on board for a longer time than is necessary to perform the trips elsewhere. He prepares himself for the formation of new acquaintances. The boat gets under-way, and no one holds himself aloof from the advances of his fellow voyager. A feeling of general interest is soon acknowledged and felt. Intimacies are entered into, and each one contributes from his own resources to the general fund of amusement. By this means the hours are beguiled of their weariness, and that, which under other auspices would be tedious, becomes a source of pleasure.

But the most inveterate talkers will tire. Recourse must be had to other resources. If the voyager has been considerate, and supplied himself with those mute, yet ever interesting companions, agreeable books, he is at no loss. But if he have not prepared himself with a shield against the attacks of enemies, he is in a pitiful condition. He lounges about the cabin—promenades the guards—gapes at the sublime scenery of the river hills—and eventually, in a fit of desperation, throws himself into his berth, and seeks, in the oblivion of sleep, to forget that he is a bore to himself. Perhaps an ingenious companion, who is similarly conquered by dullness, devises an expedient for relief. Gaming, we are sorry to say, is much too

* For example, suppose the distance between a person and any conspicuous object to be 5 English miles, and he wishes to know how much it is elevated by refraction. The correction for the earth's curvature on this distance is 16¼ feet, one seventh part of which is 2 feet 4½ inches, which it is raised by refraction.

common; and no one must consider a proposition to have recourse to that dernier resort of dullness, as any other than a genteel proposition. A proposition is made that the tedium of the hours be lost in the excitement of the card-table. Such propositions are frequently acceded to.

Now, we believe many can date the commencement of their sinning in this way from a vacant hour of steamboat travelling. A taste for such excitements has thus been originated, which has eventuated in the moral degradation of its victims. If any expedients can be adopted to guard against such occurrences, they should be entered into by such as are desirous for the welfare of their fellows with alacrity.

An interesting book, by affording agreeable entertainment, would preserve the mind from the dreary inaction of lassitude. The sickly feeling of satiety is exceedingly propitious for the advances of vice. No man when under the influence of a healthy intellectual activity wishes for change. It is in those moments when that by which we are surrounded fails to yield us pleasure, that we sigh for change, and are most liable to listen to the voice of the tempter. The seductions of vice are yielded to, and inroads are made on our moral principles. The enemy once having got possession of our bulwarks, our condition is exceedingly precarious.

Under the weight of such considerations, we plainly discover the great utility of healthy excitement. If each steamboat possessed a small library of well selected works, a pleasant resource would be afforded. The expense would be but small. The advantages would be great. A steamboat with a library on board would be preferred by every sensible man, to one which was unprovided with books. We commend the consideration of these suggestions to those engaged in fitting up steamboat cabins, and who are disposed to lessen the evils of humanity.—[Cincinnati Mirror.]

MORAL PRINCIPLES THE SAFEGUARD OF LIBERTY.—The following, from the Scottish Guardian, although not correct in all its statements or reasoning, deserves, says the Annals of Education, deep reflection, and we have been gratified to see it circulating extensively through our newspapers.

Two Magistrates of Paris recently made a tour through the United States, and in the course of two years collected important information regarding the statistics of crime and education. In the state of New-York, 500,000 children, out of two millions, are at public schools: that is, a *fourth* part of the population; and £240,000 are annually expended for this purpose. Yet in this State crime increases, and that, too, though the means of subsistence and employment are so much more easily obtained than in any other countries. In Connecticut, education is still more extended, and nearly a *third* part of the population is at school. Yet crimes multiply to a frightful extent. The Journal of Education, stating these facts, draws this cautious conclusion: "If knowledge cannot be accused of *causing* this increase of crime, at least it has not *prevented* it."

On turning to France, and examining tables of the comparative proportion of instruction in its different departments, during a period of three years, the western and central provinces have been found the most uneducated—15, 14, 13, 12, and 8 per cent. only being able to read and write; but, according to an essay on the moral statistics of France, presented to the Academy of Sciences, the *minimum* of crime is to be found in these uneducated departments, and the *maximum* in Corsica and in the south-eastern provinces, and in Alsace, where nearly half the population can read. The different employments of the population may account for the difference in part; yet still we may again draw the cautious conclusion, that if education has not *caused*, at least it has not been seen to *prevent* crime.

The only ascertained moral effect of intellectual education was stated in last March by the Lord Chancellor, in the House of Lords. In Russia, where education can scarcely be said to exist, out of 5,800 crimes committed within a certain period, 3,500 were accompanied by violence; while in Pennsylvania, where education is generally diffused, out of 7,400 crimes, only 640 were accompanied by violence, being in the proportion of $\frac{1}{12}$ of the whole number, instead of $\frac{3}{5}$, as in the former case. Thus the only ascertained effect of intellectual education on crime is to substitute *fraud* for *force*—the *cunning* of civilized, for the *violence* of savage life. Nor would even this small change be permanent. A highly intellectual community, without moral principles and the habits of self denial which religion imposes, would only prove a sleeping volcano, ready to awaken every moment, and overthrow those very institutions under which it had been fostered. To increase the intellectual power, and enlarge the knowledge, of a man void of principle, is only to create in him new desires, to make him restless and dissatisfied, hating those that are above him, and desirous of reducing all to his own level; and you have but to realize universally such a state of society, to fill the cup of the world's guilt and misery to the *brim*. What do we say then? Not certainly that education is to be withheld from any member of society,—for that question is now decided, whether we will or not,—but that from the infant school, upwards to the university, it must be a thorough *Christian* education, in which our youth shall be trained in the ways of virtuous self-control, and piety and righteousness wrought into the understanding and into the whole habit of man. A perfunctory religious

education will no longer serve—not mere Bible reading, but Bible education. The understanding must be enlightened, and the heart must be gained over to the side of truth and righteousness. In short, *the grand aim of education* must become, not merely the formation of intellectual habits, or the acquisition of secular knowledge, (as is too exclusively the case in present times,) but the formation of the Christian character. Men have hitherto been prone to take for granted, that it was only necessary to teach the art of reading, and before this new power all vice and error would flee away. These are dreams of men ignorant of themselves, and ignorant of our poor nature. Men must be trained to piety and virtue as they are trained to any other habits, whether intellectual or physical; and the moral man must advance contemporaneously with the intellectual man, else we see no increase from our increased education, but an increased capacity for evil doing.

The following application of this truth to our own country and its peculiar dangers, from the Northampton Courier, is another gratifying evidence of the increased interest taken in the subject.

"We believe that there is much truth and justice in the remark, that other influences besides that of force must be exercised, to keep the Union of these States permanently together. Statutes may be enacted, constitutions framed, and interests multiplied, but if there is not a primary feeling of moral obligation and fraternal duty, to cement and enforce them, the duration of this government, like all others, is extremely questionable and uncertain. Pecuniary interest, and common defence, and general prosperity, are but transient ties, which can be thrown off to suit the excited spirit of the times, or changed to meet any pressing emergency. They are but selfish bonds, which yield at the rude touch of popular disaffection, and are easily rent by the misguided voice of public sentiment, and vindictiveness, and clamor. But if legal enactments and obligations, and physical wants, and common defence, do not constitute security against dissolution, what influences can be exerted to sustain and strengthen a civil compact of such stupendous weight and importance as our own? If these things fail, what iron will enter the souls of men, to enforce their moral obligations, and to impress upon them the maxim of 'union,' with certain safety and security?"

We think a *moral* obligation, and religious feeling, and fraternal affection, which is founded in the heart, and has its emanations from the soul, if rightly cultivated, will insure this purpose, and guarantee its permanent duration. Some deep abiding sentiment, some strong affection of the mind, some radiating influence from the heart, which rises above selfishness, and pecuniary wants, and sordid interest, which all feel and acknowledge, is what should be cherished and cultivated, to bind with adamantine chains the different parts and sections of this our own favored country together.

Yes; it is by cultivating the sense of 'moral obligation and religious feeling,' and the 'fraternal affection,' which is their necessary concomitant and result, that our own union is to be maintained, (for we are unwilling to add the qualification which is chilling so many hearts,) and not by constitutions of parchment, or even by the arm of power. If our laws are not supported by our feelings, and principles, the force which we use to maintain them may indeed make us *fellow prisoners*, or *fellow subjects*, but never can unite us as *brethren* or *fellow citizens*. France has long sought to establish moral principle on some other basis than that of Christianity; but she has renounced this visionary plan, and now requires the *New Testament* to be employed as the text book of morals and religion in every school in the empire. Let us profit by her example, and retain the precious legacy of our purer, happier ancestors.

Examples of Self-Education.—It is not a little encouraging to those who long for the advancement of society, to see the results of that education which is gained by some in the school of nature and providence, with little of the aid of man—and in this view we publish the following example.

Mr. Ewing, U. S. Senator from Ohio, is perhaps the most conspicuous man in this State at the present time, unless Judge M'Lean be an exception. Although he has been in Congress but a single session, he has acquired a high reputation as a statesman. I should think him to be about forty. He is a self-made man—a striking exemplification of what a man can attain to by merely *personal effort*. He is a native of this State, and was born poor. In his youth, his principal employment was wood-chopping. Being very athletic, he excelled in the labors of the axe. At length, when he had become what would be called, 'a great, overgrown, awkward, brawny young man,' by a fortunate jostle, a desire for an education waked in his bosom,—he directed his steps to this institution, where he completed his education preparatory to the study of the law. In term time he chopped wood at the college door—and in vacation, it was his custom to swing his axe upon his shoulder, and go forth in search of a job; which he would accomplish, and return with fresh vigor at the commencement of the next term. In this way he sustained himself while in college, and came out with a constitution as vigorous as when he entered. And now he is a senator of the United States.

A Petrified Papoose.—Some persons employed lately in quarrying stones at Guernsey, Ohio, came across the body of an Indian child completely petrified. This extraordinary specimen was found embedded in a solid mass of rock, and has the appearance of a stone image, somewhat imperfect, to be sure, yet, on the whole, a very fair outline of a young Indian, done in lime-stone. A small row of Indian beads (too hard originally to need petrifaction, we suppose,) was found in the same cavity.

ON THE DIP AND DECLINATION OF THE NEEDLE.

To the Editor of the Mechanics' Magazine:

SIR,—P. G. V. (see vol. iii., page 368) appears anxious that the variations of the compass should be taken by practical surveyors in the United States in June and December, so that in a few years the long sought for problem may be settled. He may in a short time learn, from some observations which have been made in the city of Philadelphia, with great care, several times in the day, for nearly a year past, much of what he wishes to know; and further, that the irregular and disjointed observations of surveyors through the country, giving what they might suppose to be the correct variation of a place, could not be relied on, as it has been known to vary as much as ten minutes in half an hour. To obtain the correct variation, a number of regular observations daily for a length of time would be required, and then a few observers through the country would answer all necessary purposes. W.

AN IMPROVED BEE HIVE.—The box or hive to be made of inch plank, say about two feet three inches by twelve inches wide; the upper part of the box to be partitioned off, allowing just space sufficient to admit a drawer of about ten by twelve inches deep. This drawer is to slide upon the horizontal partition, and to be made to fit the inside of the box exactly. In the bottom of the drawer a hole is to be made, say about one and a half inch in diameter, and a corresponding one in the partition, so as to allow the bees to pass up from the lower part of the hive into the drawer. In the outer side of the drawer, a pane of glass is to be fixed, in order to ascertain when the drawer is filled with honey. Over the glass, a sliding shutter is to be placed, to exclude the light; or the upper end of the plank, forming the back side of the box, or hive, may be sawed off, and fastened with a hinge and button, so as to answer in place of the sliding shutter. When the honey is wanted for use, remove the shutter from before the glass, and having ascertained that the drawer is filled, introduce a little smoke into the top of the drawer by means of a tobacco pipe; and when the bees have been driven into the lower part of the hive, separate the drawer and partition with a case knife, remove the drawer, and having emptied it, return it to its place again, and the bees will commence working in it immediately. By this method the honey will be always pure, without bee-bread, or dead bees, and not a single bee need be destroyed; and moreover, it has been tested by many years' trial, and found to answer the intention completely. Z.

P. S.—The drawer should have a top *screwed* on, so as to be more readily opened when the honey is to be taken out; and any space between the drawer and the sides, or top of the hive, should be filled with some kind of cement, so as to prevent insects from making a lodgment within the hive.

IRON WHEELS.—We saw a waggon in Court street this forenoon, which, from the novel construction of the wheels, excited considerable curiosity in the passers-by. They were made entirely of iron—the outer part of the wheel was formed from a single piece of iron about an inch and a half square—the spokes were round, and five-eighths of an inch in diameter. The naves were constructed in a new and ingenious manner, by which the friction is much diminished; and the whole appearance of the wheels conveyed the idea of usefulness, neatness, and simplicity.

On inquiry, we learned that these wheels were calculated to sustain a weight of a ton and a half—and that wheels of the ordinary construction, to sustain so great a weight, would weigh about the same as these newly invented wheels. The expense also, we were informed, will not vary materially from those in common use. They were manufactured by Mr. Hale, of South Boston; and we believe this is the first attempt of the kind to manufacture all the parts of the wheel of iron. The advantages to be derived from this invention are neatness, safety, and durability.—[Boston paper.]

SHEET IRON GIGS.—These gigs are continuing to grow as rapidly numerous as they are increasing in public estimation. A very beautifully fitted up one was this week finished by Messrs. Reid and Hanna, and Messrs. Walker, for the Paisley Canal. Two others are in a state of great forwardness for Dublin; and several others, for various canals, are also in preparation. This business of gig making has extended to Johnstone, also, where there are six or seven of them getting forward for various canals both in Ireland and Scotland. Steam-coaches will find in these gigs most powerful competitors to contend with.

The increase of trade upon all the canals on which they have been introduced is quite astonishing. The bustle at the basin here and at Port Eglinton, by the hourly departure, is quite enlivening, and we understand the travelling by the Forth and Clyde Canal is increased in a most astonishing degree. Indeed, from the speed they have attained, and the low prices charged to Edinburgh, Stirling, Alloa, &c. no other result could be expected.—[Paisley Advertiser.]

FOSSIL HORNS.—In excavating the Lancaster Lateral Canal, near a place called the "Deep Cut," bones of extraordinary dimensions have been discovered. Among the curiosities found is a horn six feet in length, weighing 44 lbs., and measuring at the butt end sixteen inches. Also, a tooth weighing 6¾ lbs.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum, *in advance*.—JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.